Minimizing Nurses' Risks for Needle Stick Injuries

In the Hospital Setting

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MINIMIZING NURSES' RISKS

To the Faculty of Washington State University:

The members of the Committee appointed to examine the project of KARIN ROHDE find it satisfactory and recommend that it be accepted.

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Abstract

Despite advances in safety mechanisms for sharps, nurses continue to be at high risk for needle stick injuries (NSIs) with more than half being directly affected by at least one during their career. NSI risk appears to be a result of three main factors surrounding NSI incidents. They include nurses' sense of urgency, variable shift work, and lower skill level. This paper provides a synthesis of the evidence relating to these risk factors among nurses in hospital settings. Evidence linking NSI risk with both variable shift work and lower skill level are demonstrated. The evidence supporting a relationship between NSI risk and nurses' sense of urgency, on the other hand, is conflicting. Gaps in research are identified and changes to nursing practice are recommended based on these findings.

Keywords: needle sticks; nurses; sharps injuries in nurses; skill level and needle sticks; shift work, urgency and sharps injuries
Minimizing Nurses’ Risks for Needle Stick Injuries in the Hospital Setting

Introduction

Needle stick injuries (NSIs) have been a risk for health care workers for years and continue to be problematic (Perry & Jagger, 2005). Most of these injuries happen to nurses (AHC Media, 2010; Tabak, Shiaabana, & ShaSha, 2005), with estimates of close to 74% of all NSIs in health care workers being in this group (Lee, Botteman, Xanthakos, & Nicklasson, 2005). Nationwide, nearly 11% of nurses have suffered a NSI in the last 12 to 24 months (Kable, Guest, & McLeod, 2011) and 64% suffered at least one during their career (Trossman, 2010). In hospital settings, many nurses sustain NSIs while at the bedside after patient contact but prior to needle disposal (Smith, Smyth, Leggat, & Wang, 2006). This occurs frequently either by recapping or disengaging needles (Feng & Liu, 2009). NSIs are expensive for both the injured nurse and healthcare industry; immediate and follow-up treatment for exposed employees was reported to cost from $71 to $5,000 per case (Centers for Disease Control and Prevention, 2008).

Primary issues related to NSIs involve scratches, punctures, or lacerations of the skin with fingers affected most often (Bohnker & Bowman, 2005). If the needle from which the injury occurred was contaminated, a number of secondary issues arise as well. These may include, but are not limited to, transmission of blood-borne viruses and other pathogens, expensive prophylactic treatments and related side effects, and worry surrounding the incident (Lee et al., 2005). The first purpose of this paper is to examine the literature for evidence of a relationship among certain factors associated with NSIs in nurses in hospital settings, including nurses’ sense of urgency, variable shift work, and lower skill level. The second purpose of this paper is to make recommendations for practice and future research based on these findings.
Theoretical Frameworks

Two theoretical frameworks guided this review. Both are relevant to hospital nurses’ risk factors for NSIs. When viewed together, they provide a framework to examine risk factors and strategies to prevent NSIs.

Control strategies for occupational exposures (or, more simply, “control” strategies) are described first. Levy and Wegman (2000) advocated that a hierarchy of three types of controls should be implemented, in a certain order, to decrease risk for occupational exposure (Salazar, 2006). The first level of controls is engineering controls. These involve altering the environment or the processes that pose risks, such as replacing all needles without retractable safety devices with those that are engineered with safety in mind. Engineering controls should be implemented before all others, as they have been found to be most successful. The second level of controls is administrative. It includes strategies such as requiring ongoing safety training or setting limits on nursing patient loads or consecutive hours worked each shift (Salazar, 2006). The third set of controls involves personal protective equipment (PPE). PPE, although a simple strategy to implement, has been deemed the least successful at reducing risk for occupational harm (Levy & Wegman, 2000).

Applied behavior analysis is described next. Baer, Wolf, and Risley (1968) stated that unintentional injury prevention occurs through the reduction of risk (Gielen & Sleet, 2003). In essence, it is very similar to the control strategies framework in its goal of risk reduction. However, it suggests just two strategies in support of this claim. Consciously behaving in certain ways to limit harm is one method (active prevention). Altering the environment for this same purpose is another (passive prevention) (Baer et al., 1968). When looking at the control strategies framework, administrative and PPE controls are active prevention measures and
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engineering controls are passive prevention measures (Levy & Wegman, 2000; Salazar, 2006).

Observing and interpreting those strategies surrounding the concept of risk reduction are central to both frameworks. When looking at NSIs in nurses from both theories, it becomes evident that this important occupational risk can be greatly reduced. Engineering, administrative, and PPE controls can be applied to both actively and passively seek solutions to prevent NSIs.

Literature Review

The Cumulative Index to Nursing and Allied Health Literature (CINAHL), Google Scholar, and PubMed databases were searched using key terms and MeSH headings: needle sticks in nurses; nurses and needlestick injuries; sharps injuries in nurses; skill level and needle sticks; shift work, urgency and sharps injuries. Numerous articles were identified initially using this strategy. Seventeen articles examined the three risk factors of interest: nurses’ sense of urgency (five articles), variable shift work (five articles), and lower skill level (seven articles). There was some overlap between studies looking at multiple risk factors. Other risk factors associated with NSIs that will not be discussed in depth in this review include lack of protective equipment, recapping needles (Smith et al., 2006), or nursing positions that require a higher-than-average use of needles throughout one’s workday (Trinkoff, Le, Geiger-Brown, & Lipscomb, 2007).

Review of Findings

The literature review was divided into three major sections. As mentioned above, they are: sense of urgency, variable shift work, and lower skill level. Findings are described next.

Sense of Urgency
Feeling a sense of urgency in nursing is defined as feeling pressured to get work done faster (Patrician, Pryor, Fridman, & Loan, 2011) because of job-related busyness, high workloads, and/or decreased nurse-to-patient ratios (i.e. low staffing) (Clark, 2007). Five articles were found that supported NSIs in nurses being related to sense of urgency. In 2008, the American Nurses Association polled a sample of nurses (N = 706) and determined more than half (59%) perceived an elevated risk for NSIs when they felt pressured to get their work done more quickly (test statistic not reported). Results were based on perceptions of NSI risk instead of actual risk. Smith et al. (2009) surveyed 995 nurses in Japan and noted those who felt rushed did not always utilize Universal Precautions and thus were significantly more apt to have had an NSI (OR = 0.71; 95% CI: 0.47-1.06). Feng and Lui (2009) identified that clinical nurses (N = 186), when feeling a sense of urgency, did not routinely use safety mechanisms when handling sharps (test statistic not reported). Other factors for increased risk of NSIs when nurses are busy include higher patient loads, a sense of being overwhelmed, or, urgency, to complete job duties (Clarke, Rockett, Sloane, & Aiken, 2002).

One article was identified that did not support this claim, however. Clarke (2007) determined an insignificant correlation (P = 0.09) between nurses’ (N = 11,512) busyness, due to suboptimal staffing, and actual NSIs (OR = 0.85; 95% CI: 0.71-1.03). Thus, there is mixed evidence regarding this relationship (see Table 1).

**Variable Shift Work**

A relationship between NSIs and working variable nursing shifts was examined. Variable shift work is defined as working shifts greater than 12 consecutive hours (Trinkoff et al., 2007) or being on a rotating shift schedule (Smith et al., 2006; Trinkoff, 2009). Five studies were identified that examined this relationship. Trinkoff et al. (2007) conducted a longitudinal
survey in three waves that addressed NSIs in nurses (N = 2,624) and variable shift work. Findings supported their theory that working 12 or more hours per shift was significantly linked to higher rates of NSIs \((P < 0.01; RR = 1.63; 95\% CI: 1.17-2.26)\). In 2009, Trinkoff conducted another longitudinal study in which NSIs in nurses (N = 2,273) were examined relative to variable shift work. Results showed that risk for injury was highest when nurses worked more than 13 hours, more weekends, and rotating shifts (statistical analysis unavailable). Canini et al., (2008) identified a statistically significant \((OR = 2.77; 95\% CI: 1.35-5.70)\) increase in NSIs when nurses worked nights or a combination of days and nights. Other studies have supported the idea that shifts of 12 hours or longer, rotating shift work (Smith et al., 2006), and nocturnal or other shifts that increase nurses’ risk for poor sleep put nurses at risk for occupational accidents \((OR = 1.0; 95\% CI: 0.85-1.10)\) (Suzuki et al., 2005). As evidenced here, the literature supported the claim that variable shift work gives rise to NSI risk (see Table 1).

Lower Skill Level

Lower skill level is a concept defined in a variety of ways in the literature. Studies discussed here included skill level relative to academic degree type, age, and/or years worked as a professional nurse.

Patrician et al. (2011) analyzed a total of 13 hospitals and 108,000 shifts from units on which 4,553 nurses worked. Specifically, they attempted to determine whether there was a relationship between nurses’ educational degree and NSI risk. They identified a statistically significant decrease \((OR = 1.32; 95\% CI: 1.14-1.54)\) in NSIs when more registered nurses (RNs) versus licensed practical nurses (LPNs) worked.

Six studies identified a correlation between lower skill level and NSIs when skill level was defined as age and/or years of experience working as a nurse. Clarke (2007) surveyed
nurses (N = 11,512) and examined years of experience and number of NSIs suffered. Results demonstrated a statistically greater incidence of NSIs (P = 0.03) in nurses who had worked less than five years (OR = 1.23; 95% CI: 1.02-1.49). Feng and Lui (2009) surveyed 186 clinical nurses’ attitudes towards trialing new safety syringes; they noted a higher degree of confidence using these syringes in more experienced nurses working in administration as compared to staff nurses with less experience (r = -0.156; P = 0.035). These researchers discovered that approximately half of the clinical nurses in their sample had been working for two years or less. Canini et al. (2008) discovered nurses (N = 200) with five years or less work experience had significantly higher rates of NSIs than nurses who had worked longer (OR = 6.70; 95% CI: 2.42-18.53). Clarke et al. (2002) identified nurses with less than five years of nursing experience in their sample (N = 2,287) to be at higher risk for NSIs (OR = 1.48; 95% CI: 1.06-2.20). And finally, Smith et al. (2006) showed a significant correlation between NSI risk in nurses younger than 27 years (OR = 4.5; 95% CI: 1.7-12.6) with fewer years of experience, a finding further supported by Suzuki et al. (2005) (test statistic unavailable). In its entirety, authors in the reviewed literature agreed that NSI risk was higher in nurses with lower skill level relative to academic degree type, age, and years of experience (see Table 1).

Table 1: Literature review abstraction by NSI risk factor type.

<table>
<thead>
<tr>
<th>AUTHORS (YEAR)</th>
<th>STUDY DESIGN</th>
<th>POPULATION</th>
<th>SENSE OF URGENCY</th>
<th>VARIABLE SHIFT WORK</th>
<th>LOWER SKILL LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Nurses Association (2008)</td>
<td>Cross sectional</td>
<td>706 nurses</td>
<td>Perception of &gt;NSIs when RN workloads are high (test statistic not reported)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Canini et al. (2008)</td>
<td>Case control</td>
<td>400 nurses (200 cases, 200 controls)</td>
<td>N/A</td>
<td>More NSIs in RNs who worked nights or days/nights OR = 2.77 95% CI: 1.35-5.70</td>
<td>Nurses who had worked &lt;5 years had more NSIs OR = 6.70 95% CI: 2.42-18.53</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Sample Size</td>
<td>Key Findings</td>
<td>Reference</td>
<td></td>
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<td>-------------------------------</td>
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</tr>
<tr>
<td>Clarke Cross (2007)</td>
<td>Sectional</td>
<td>11,512 nurses</td>
<td>Negative relationship between RN busyness &amp; NSI P=0.09 OR = 0.85 95% CI (0.71-1.03)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Clarke et al. (2002)</td>
<td>Sectional</td>
<td>2,287 nurses</td>
<td>&gt;NSIs when RNs had higher patient loads OR = 1.52 95% CI: 1.06-2.20</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Feng &amp; Lui (2009)</td>
<td>Descriptive</td>
<td>186 nurses</td>
<td>Sharps safety mechanisms inconsistently used when RNs felt rushed; &gt;NSIs (test statistic not reported)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Patrician et al. (2011)</td>
<td>Sectional</td>
<td>4,553 nurses</td>
<td>Sense of urgency = Universal Precautions not always being used; perception of &gt;NSI risk OR = 0.71 95% CI: 0.47-1.06</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Smith et al. (2006)</td>
<td>Sectional</td>
<td>330 nurses</td>
<td>Working rotating shifts &gt;NSI risk compared to RNs who worked all day shifts OR = 4.0 95% CI: 1.7-10.4 P&lt;0.05</td>
<td>Positive relationship between RNs &lt;27 years old and &gt;NSI risk OR = 4.5 95% CI: 1.7-12.6 P&lt;0.05</td>
<td></td>
</tr>
<tr>
<td>Smith et al. (2009)</td>
<td>Sectional</td>
<td>995 nurses</td>
<td>Nights or other shifts that &gt; risk for poor sleep result in &gt;NSIs OR = 1.0 95% CI: 0.85-1.10</td>
<td>Younger age is correlated with &gt;NSI risk (test statistic not reported)</td>
<td></td>
</tr>
<tr>
<td>Suzuki et al. (2005)</td>
<td>Sectional</td>
<td>4,407 nurses</td>
<td>N/A</td>
<td>RNs who worked 12 or more hours per shift had more NSIs RR = 1.63 P&lt; 0.01 N/A</td>
<td></td>
</tr>
<tr>
<td>Trinkoff et al. (2007)</td>
<td>Longitudinal</td>
<td>2,624 nurses</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
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</tbody>
</table>
### Discussion

**Significance to Nursing**

Control strategies for occupational exposure and the applied behavior analysis framework describe how NSIs in nurses can be prevented by implementing certain controls (Levy & Wegman, 2000; Salazar, 2006) and by developing passive and active strategies (Baer et al., 1968) that influence the identified risk factors. Engineering controls can be utilized to structure nurses’ working environments to reduce or limit harm. For example, sharps with safety mechanisms can be purchased by hospitals and training required to ensure their use by nurses at all times, even when they are busy. Sharps without these safety mechanisms should be removed entirely from the workplace. Administrative controls may be utilized as well. Institutional policies can limit the number of hours per shift nurses are working, keeping the upper limit at 12 consecutive hours (Trinkoff et al., 2007), and allowing for ample rest between shifts. As previously described, there is conflicting evidence whether sense of urgency actually increases NSIs in the nursing work place. Hospitals should continue structuring work environments to reduce stress until conclusive evidence is determined. These are measures that will passively allow for a safer work environment for staff nurses.

![Table]

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Sample Size</th>
<th>N/A</th>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trinkoff (2009)</td>
<td>Longitudinal</td>
<td>2,273 nurses</td>
<td>N/A</td>
<td>13 or more hrs/shift, more weekends, rotating shifts &gt;NSI risk (test statistic not reported)</td>
</tr>
</tbody>
</table>

CI = confidence interval; LPN = licensed practical nurse; N/A = not applicable; NSI = needle stick injury; OR = odds ratio; P = p-value; r = correlation coefficient; RN = registered nurse
In addition, managers can facilitate a safer culture in hospitals. They can be taught to staff their units with an appropriate mix of experienced and inexperienced nurses. Staff nurses' skill levels can also be targeted. All newly-hired nurses should participate in facility orientations that involve training on workplace safety and appropriate use of sharps safety mechanisms (Smith et al., 2006). In addition, all hospital nurses should be required to review sharps safety on a regular basis. Evidence supports these controls and other preventive actions.

Nurses using sharps must utilize all avenues to protect themselves. PPE is the last control strategy recommended. It is the least effective of the control strategies, as mentioned earlier, but is a simple one to follow and should be encouraged when needed. In terms of risk for NSI, it means gloves must be made widely available to and worn by all persons using sharps. Although not puncture-proof, gloves are easy to apply and provide a small degree of barrier protection. In addition, hospital infection control and/or employee safety committees may enact measures that ensure employees are following these recommendations as well as reporting NSI incidents for appropriate treatment, follow up, and case tracking.

**Recommendations for Future Research**

The literature provided an understanding of research conducted in the arena of NSI risk in nurses relative to their sense of urgency, variable shift work, and lower skill level. The literature clearly defines and operationalizes nurses’ sense of urgency and variable shift work. However, lower skill level was inconsistently defined. Future researchers might further examine skill level in nurses and identify clearer conceptual and operational definitions in terms of academic degree type, age, and the precise number of years worked that correlate with an increase in NSI risk. In addition, due to the conflicting findings surrounding NSI risk and nurses’ sense of urgency, more research is needed to clarify whether a sense of urgency increases actual risk versus perceived
risk. Moreover, if a link between NSI risk and sense of urgency is supported in future studies, additional strategies for reducing those factors in the workplace (i.e. workload, stress, or sense of overwhelm) must be identified.

**Conclusion**

In conclusion, this paper analyzed evidence for increased NSI risk in hospital nurses when three variables were present: a sense of urgency, variable shift work, and lower skill level. Findings showed mixed evidence relating to the relationship between sense of urgency and nurses’ NSI risk (American Nurses Association, 2008; Clarke, 2007; Clarke et al., 2002; Feng & Lui, 2009; Smith et al., 2009). On the other hand, the literature supported variable shift work (American Nurses Association, 2008; Canini et al., 2008; Smith et al., 2006; Suzuki et al., 2005; Trinkoff, 2009; Trinkoff et al., 2007) and lower skill level being associated with increased risk for NSIs (Canini et al., 2008; Clarke, 2007; Feng & Lui, 2009; Patrician et al., 2011; Smith et al., 2006). Implications and significance to nursing based on these findings were discussed and future research needs were suggested.

**In Summary**

- Evidence suggests that hospital nurses who work variable shifts and/or have a lower skill level are at an increased risk for NSIs. Risk may also be increased during times when nurses feel a sense of urgency to complete job tasks.
- Engineering controls, including limiting sharps use to only those with safety mechanisms, must be ensured in hospital workplaces to reduce NSIs.
- Administrative controls involve educating hospital nurses on appropriate shift staffing and sharps safety mechanism use and enforcing policies that do not allow nurses to work more than 12 consecutive hours.
• Emphasis should be placed on implementing engineering and administrative controls first; however, PPE should also be used to prevent NSIs.


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